Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 (canceled).

2 (currently amended). The method as claimed in claim ~~1~~ <u>20</u> wherein scene spatial information is provided as image values in a local three-dimensional coordinate system of each of the images and the step of deriving a three-dimensional panorama comprises the steps of:

(i) transforming the image values from each of the local three-dimensional coordinate systems of each of the images to a selected reference three-dimensional world coordinate system, thereby providing transformed range images;

(ii) warping the transformed range images onto a cylindrical surface, and forming a plurality of warped range images;

(iii) registering adjacent warped range images; and

(iv) deriving the three-dimensional panorama using the warped range images.

3 (canceled).

4 (previously presented). A method for deriving a three-dimensional panorama from a plurality of images of a scene generated from a range imaging camera of the type that produces ambiguities in range information, said method comprising the steps of:

acquiring a plurality of images of the scene by rotating the camera about a Y-axis (vertical axis), wherein there is an inter-overlap region and known spatial relation between adjacent images and at least two of the adjacent images are range images, said range images each having relative scene spatial information, said range images differing by said known spatial relation and an unknown relative range difference;

estimating said relative range difference to provide an estimate;

automatically optimizing said estimate to provide an optimized constant range offset;

automatically applying said constant range offset to one of said range images to provide corrected relative scene spatial information (X,Y,Z) of one of said range images with respect to a first local XYZ coordinate system and relative scene spatial information (X,Y,Z) of the other of said range images with respect to a second local XYZ coordinate system;

selecting a reference three-dimensional world coordinate system against which spatial information of the scene can be correctly presented;

transforming the corrected relative scene spatial information (X,Y,Z) from each of the local three-dimensional coordinate systems of each of the images to the selected reference three-dimensional world coordinate system, thereby providing transformed (X,Y,Z) images;

warping the transformed (X,Y,Z) images onto a cylindrical surface, and forming a plurality of warped (X,Y,Z) images;

registering adjacent warped (X,Y,Z) images; and

forming a three-dimensional (X,Y,Z) panorama using the warped (X,Y,Z) images.

5 (cancelled).

6 (original). The method as claimed in claim 4 wherein the plurality of images generated from the range imaging camera includes color images and the three dimensional panorama is in color.

7 (original). The method claimed in claim 4 wherein the reference three-dimensional world coordinate system is an arbitrary three-dimensional coordinate system.

8 (previously presented). The method claimed in claim 7 further comprising the step of selecting the reference three-dimensional world

coordinate system from the local three-dimensional coordinate systems or a predefined three-dimensional coordinate system.

9 (previously presented). The method claimed in claim 4 wherein said step of transforming the corrected relative scene spatial information (X,Y,Z) comprises forming a homogeneous transformation matrix.

10 (original). The method as claimed in claim 4 wherein each image is captured as a bundle of associated images, said bundle including a plurality of phase images each incorporating the effect of a predetermined modulation frequency together with a phase offset unique for each image.

11 (original). The method as claimed in claim 10 wherein each range image is generated from a respective plurality of phase images associated with each bundle.

12 (original). The method as claimed in claim 10 wherein the bundle also includes an intensity image.

13 (original). The method as claimed in claim 12 wherein the intensity image is a color image.

14 (cancelled).

15 (previously presented). A three-dimensional panoramic imaging system, comprising:

(a) a three-dimensional panoramic capturing system, wherein a sequence of image bundles are produced, each said image bundle having a plurality of phase images each having relative range values, each said image bundle having at least one intensity image, each said image bundle having a known capture position defining a known spatial relation between said images of adjacent said image bundles, said phase images of adjacent said image bundles also differing by an unknown relative range difference;

(b) a reference coordinate transformation system having an offset estimating component estimating ~~a~~ said relative range difference to provide an estimated constant offset between phase images of adjacent said image bundles, optimizing said estimated constant offset to provide an optimized constant offset, and applying said optimized constant offset to respective said image bundles to provide corresponding spatial images, and a general homogenous transformation matrix for transforming each of the spatial images into a common three-dimensional coordinate system based on said optimized constant offset;

(c) an image stitching system that produces a stitched spatial panorama from the transformed spatial images, and a stitched intensity panorama from the sequence of intensity images; and

(d) a graphics display system for receiving the stitched spatial and intensity panoramas and generating a virtual world reality.

16 (currently amended). A computer program product for deriving a three-dimensional panorama from a plurality of images of a scene generated by a range imaging camera of the type that produces ambiguities in range information, said computer program product comprising: a computer readable storage medium having a computer program stored thereon for performing the steps of:

(a) accessing a plurality of adjacent images of the scene, said adjacent images ~~each~~ having ~~a known capture position defining~~ <u>capture positions differing by camera rotation about a Y-axis (vertical axis), wherein there is an overlap region and</u> a known spatial relation between said adjacent images, ~~wherein there is an overlap region between the adjacent images~~ and at least some of the adjacent images are range images, said range images each having relative range values, said range images differing by said known spatial relation and an unknown relative range difference;

(b) automatically providing offset data for the range images in order to recover corrected relative scene spatial information, wherein the step of providing offset data further comprises:

(i) estimating said relative range difference between the adjacent range images to provide an estimated constant offset;

(ii) optimizing said estimated constant offset to provide an optimized constant offset;

(iii) applying the optimized constant offset to at least one of adjacent range images to correct for ambiguities in the relative ranges of the range images, thereby providing corrected range images; and

(c) deriving a three-dimensional panorama from the corrected range images.

17 (previously presented). A computer program product for deriving a three-dimensional panorama from a plurality of images of a scene generated from a range imaging camera of the type that produces ambiguities in range information, said computer program product comprising: a computer readable storage medium having a computer program stored thereon for performing the steps of:

accessing a plurality of images of the scene by rotating the camera about a Y-axis (vertical axis), wherein there is an inter-overlap region and known spatial relation between adjacent images and at least two of the adjacent images are range images, said range images each having relative scene spatial information, said range images differing by said known spatial relation and an unknown relative range difference;

estimating said relative range difference to provide an estimate;

automatically optimizing said estimate to provide an optimized constant range offset;

automatically applying said constant range offset to one of said range images to provide corrected relative scene spatial information (X,Y,Z) of one of said range images with respect to a first local XYZ coordinate system and relative scene spatial information (X,Y,Z) of the other of said range images with respect to a second local XYZ coordinate system;

selecting a reference three-dimensional world coordinate system against which spatial information of the scene can be correctly presented;

transforming the corrected relative scene spatial information (X,Y,Z) from each of the local three-dimensional coordinate systems of each of the images to the selected reference three-dimensional world coordinate system, thereby providing transformed (X,Y,Z) images;

warping the transformed (X,Y,Z) images onto a cylindrical surface, and forming a plurality of warped (X,Y,Z) images;

registering adjacent warped (X,Y,Z) images; and

forming a three-dimensional (X,Y,Z) panorama using the warped (X,Y,Z) images.

18 (cancelled).

19 (previously presented). A computer program product as claimed in Claim 17 wherein said step of transforming the generated (X,Y,Z) values comprises forming a homogeneous transformation matrix.

20 (currently amended). A method for deriving a three-dimensional panorama from a plurality of images of a scene generated by a range imaging camera of the type that produces ambiguities in range information, said method comprising:

acquiring a plurality of adjacent images of the scene, wherein there is an overlap region between the adjacent images and at least some of the adjacent images are range images;

providing offset data for the range images in order to recover corrected relative scene spatial information, wherein the providing offset data includes:

detecting a relative range difference between adjacent range images as a constant offset between the adjacent images by:

predicting the relative range difference by an estimated constant offset;

warping the range images onto a cylindrical surface using the estimated constant offset, and forming a plurality of warped range images;

registering adjacent warped range images, thereby producing predicted range values;

evaluating any error between the predicted range values and the actual range values in the overlap region;

if the error is unacceptable, using an optimization routine to select another estimated constant offset; and

repeating the warping, registering and evaluating until the error is acceptable, thereby producing the constant offset~~.~~;

applying the constant offset to at least one of adjacent range images to correct for ambiguities in the relative ranges of the range images, thereby providing corrected range images; and

deriving a three-dimensional panorama from the corrected range images.

21 (currently amended). The method as claimed in claim ~~1~~ 22 wherein said optimizing further comprises:

warping said range images onto a cylindrical surface using said estimated constant offset to provide a plurality of warped range images;

registering adjacent said warped range images, thereby producing predicted range values;

evaluating any error between said predicted range values and actual said range values in said overlap region;

if said error is unacceptable, using an optimization routine to select another estimated constant offset; and

repeating said warping, registering, evaluating, and using until said error is acceptable, thereby producing said optimized constant offset.

22 (currently amended). A method for deriving a three-dimensional panorama from a plurality of images of a scene generated by a range imaging camera of the type that produces ambiguities in range information, said method comprising the steps of:

acquiring a plurality of image bundles of the scene, said image bundles ~~each~~ having ~~a known capture position,~~ capture positions differing by camera rotation about a Y-axis (vertical axis), wherein there is an inter-overlap region and known spatial relation between adjacent said image bundles, each said image bundle having ~~a plurality of~~ an intensity image and

three or more phase shift range images each having ~~relative range values,~~ a different phase shift;

~~said phase images of adjacent said image bundles~~ calculating range images from each of said image bundles, said range images each having three dimensional relative range values, adjacent said range images differing by a known spatial relation defined by respective said known capture positions and differing by an unknown relative range difference;

estimating said relative range difference between adjacent said range images to provide an estimated constant offset between the adjacent images;

automatically optimizing said estimated constant offset to provide an optimized constant offset; and

deriving a three-dimensional panorama from said range images and said optimized constant offset.

23 (previously presented). The method of claim 22 wherein said estimating further comprises using said known spatial relation.

24 (canceled).

25 (currently amended). The method of claim ~~1~~ 23 wherein said known spatial relation is an angular offset.

26 (new). A method for deriving a three-dimensional panorama from a plurality of images of a scene generated from a range imaging camera of the type that produces ambiguities in range information, said method comprising the steps of:

acquiring a plurality of images of the scene by rotating the camera about a Y-axis (vertical axis), wherein there is an inter-overlap region and known spatial relation between adjacent images and at least two of the adjacent images are range images, said range images each having relative scene spatial information, said range images differing by said known spatial relation and an unknown relative range difference;

estimating said relative range difference to provide an estimate;

automatically optimizing said estimate to provide an optimized constant range offset;

automatically applying said constant range offset to one of said range images to provide corrected relative scene spatial information (X,Y,Z) of one of said range images with respect to a first local XYZ coordinate system and relative scene spatial information (X,Y,Z) of the other of said range images with respect to a second local XYZ coordinate system;

selecting a reference three-dimensional world coordinate system against which spatial information of the scene can be correctly presented;

transforming the corrected relative scene spatial information (X,Y,Z) from each of the local three-dimensional coordinate systems of each of the images to the selected reference three-dimensional world coordinate system, thereby providing transformed (X,Y,Z) images.

27 (new). A method for deriving a three-dimensional panorama from a plurality of images of a scene generated by a range imaging camera of the type that produces ambiguities in range information, said method comprising:

acquiring a plurality of adjacent images of the scene, wherein there is an overlap region between the adjacent images and at least some of the adjacent images are range images;

estimating a constant offset between adjacent range images;

warping the range images onto a cylindrical surface using the estimated constant offset, and forming a plurality of warped range images;

registering adjacent warped range images, thereby producing predicted range values;

evaluating any error between the predicted range values and the actual range values in the overlap region;

if the error is unacceptable, using an optimization routine to select another estimated constant offset;

repeating the warping, registering and evaluating until the error is acceptable, thereby producing the constant offset;

applying the constant offset to at least one of adjacent range images to correct for ambiguities in the relative ranges of the range images, thereby providing corrected range images; and

deriving a three-dimensional panorama from the corrected range images.